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Investigative Program
Northern Rocky Mountain Region

June 19, 1934.

REGION ONE INVESTIGATIVE COUNCIL

ANNUAL REPORT FOR 1933

and

PROGRAM FOR FISCAL YEAR 1935

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ROCKY MOUNTAIN STATION

For the Investigative Council

/s/ Lyle F. Watts
Secretary

Approved June 19, 1934.

/s/ Frank J. Jefferson
Acting Regional Forester

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INVESTIGATIVE COUNCIL

The annual meeting of the Regional Investigative Council for the Northern Rocky Mountain Region was held at the University of Montana, Missoula, Montana, on March 1 and 2, 1934. Because of restrictions on use of State funds outside State boundaries, no one from the University of Idaho attended, but their program was presented as usual. All other agencies engaged in forest and range research were represented.

ATTENDANCE

The individuals listed below attended all, or part, of the sessions:

FOREST SERVICE, REGION ONE.

E. W. Kelley,	Regional Forester and Chairman
Elers Koch,	Forest Management
D. S. Olson,	Forest Management
G. A. Smith,	Range Management
E. A. Schilling,	Range Management
M. H. Wolff,	Lands
R. F. Hammatt,	Public Relations
L. C. Stockdale,	Operation
F. J. Jefferson,	Operation
H. R. Richards,	Operation

FOREST SERVICE, ~~NORTHERN ROCKY~~ MOUNTAIN EXPERIMENT STATION

L. F. Watts,	Director and Secretary
R. H. Weidman,	Silviculture
Kenneth Davis	Silviculture
L. G. Hornby,	Fire
H. T. Gisborne,	Fire
G. M. Jemison,	Fire
L. C. Hurtt,	Range
Fred Kennedy,	Range
M. I. Bradner,	Forest Survey
G. M. DeJarnette,	Forest Survey
I. V. Anderson,	Forest Products
C. N. Whitney,	Forest Products

UNIVERSITY OF MONTANA

I. W. Cook,	Acting Dean, School of Forestry
F. G. Clark,	Professor, School of Forestry
J. H. Ramskill,	Professor, School of Forestry
E. W. Nelson,	Professor, School of Forestry
C. W. Waters,	Professor, School of Forestry

MONTANA STATE COLLEGE

E. A. Starch,	Professor, School of Agriculture
Clyde McKee,	Professor, School of Agriculture
M. H. Saunderson,	Professor, School of Agriculture

OFFICE OF BLISTER RUST CONTROL, SPOKANE, WASHINGTON

Stephen N. Wyckoff, Senior Pathologist

C. C. Strong,

BUREAU OF ENTOMOLOGY, COEUR d'ALENE FIELD STATION

J. C. Evenden, Director

PACIFIC NORTHWEST SOIL EROSION STATION

W. A. Rockie, Regional Director

STATE OF MONTANA

Rutledge Parker, State Forester

PRIVATE AGENCIES

Roscoe Haines, A. C. M. Co., Missoula, Montana

J. Bruce Orcutt, Harriman-McIntosh Lands, Beebe, Montana

MATTERS OF GENERAL INTEREST

EXTENT OF RESEARCH BY ALL AGENCIES

The past year proved to be one of reductions in expenditures in regular appropriations and increases in total expenditures through the use of the various emergency funds. While this situation prevented the best planning of project work, and in some instances resulted in the initiation of other than the most urgent projects, it did enable the various agencies to make substantial progress. The unsatisfactory condition thus created makes the information contained in Table One somewhat misleading, in that the amount of research work actually accomplished exceeds that indicated by the expenditures listed.

NUMBER OF RESEARCH PROJECTS AND EXPENDITURES, BY LINES OF WORK

Northern Rocky Mountain Region

Calendar Year 1933
(Last Half of F. Y. 1933 and First Half F. Y. 1934)

Line of Work	AGENCY																		Plant Investment N.R.M. Exp. Sta. C.Y. 1933
	Blister Rust Cont.		Bur. of Entomology		Montana Exp.Sta.		Univ. of Idaho		Univ. of Montana		Weather Bureau		For. Ser. Region 1		N.R.M. Exp.Sta.		Totals		
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No. 3/	Amount	No. 1/	Amount	No.	Amount	No.	Amount	No.	Amount	
Art. Reforestation							2	None					3	145			5	145	
Management							3	2,215							5	13,924	8	16,139	)
Mensuration															3	2,980	3	2,980	) 7,621
Protection	8	27,109	9	13,000			2	1,951			3	3,500	1	3,000	2	24,033	25	72,593	)
Products							3	2,835							5	9,754	8	12,589	
Grazing															1	7,790	1	7,790	)
Artificial Reseeding															1	1,665	1	1,665	) 4,215
Economics					4	2/ 6,500							1	50	2	19,363	7	25,913	
Ecology																			
Miscellaneous								855					2	400	3	1,646	5	2,901	
Totals	8	27,109	9	13,000	4	6,500	10	7,856			3	3,500	7	3,595	22	81,155	63	142,715	11,836

1. Estimated.
2. Range and Land Use.
3. No information submitted.

CIVILIAN CONSERVATION CORPS

The initiation of work by the Civilian Conservation Corps proved to be a distinct advantage to forest research. One entire camp was assigned to the Priest River Experimental Forest. This made possible the construction of approximately fourteen miles of road on the area, the thinning of about 30 acres of young white pine and the establishment of a series of seven thinning plots, the disposal of snags on about 100 acres of old burn, besides a long list of minor jobs. After July 1 several enrollees were selected for and used on research project work in lieu of the regular temporary men which had to be dropped because of decreases in regular allotments.

In Montana ten CCC enrollees were used for about two months on a thinning project in the ponderosa pine type on the Lolo Forest. About 20 acres were thinned and nine permanent plots were established.

During the third work period, April 1 to September 30, 1934, one full camp will be employed on work at Priest River Experimental Forest and one at the Deception Creek Experimental Forest.

Experimental work on the University of Idaho Experimental Forest was given great impetus by the establishment of a CCC camp on that unit during the winter of 1933-1934. Material progress was made in establishing stand improvement plots, planting poorly stocked or unstocked areas, fireproofing the area and developing a road, trail and protection

system.

NATIONAL INDUSTRIAL RECOVERY ACT

Much urgently needed work was made possible by appropriations under the National Industrial Recovery Act. At the Priest River Experimental Forest a new five-stall garage was constructed, a 150' weather observation tower was purchased, and the material is on the ground for constructing an additional three-room dwelling. At the Deception Creek Experimental Forest some 16 acres of 40-year-old white pine were thinned, a series of seven permanent plots were established, more than 3,000 snags were felled on an old timber sale area, and about five miles of the main road across the area were fireproofed.

At Fort Keogh, the office used by the Range Research personnel was remodeled, a new garage was constructed, and several miles of much needed fencing were completed. In addition, a good start was made on the artificial range reseeding project. NIRA funds, allotted to research work late in the summer of 1933, enabled the Station to complete the program of work for the year.

Improvement plans for F. Y. 1935 call for the building of one five-room residence, one three-room residence to be used temporarily as an office, one five-stall garage and tool house, and a water system at the Deception Creek Experimental Forest.

At Priest River sufficient funds to construct the additional residence are provided.

CIVIL WORKS ADMINISTRATION

The Station was allotted 20 people in Montana and 25 in Idaho under the Civil Works Administration. In Idaho, the major project was the construction of 13½ miles of power line from Priest River to the Priest River Experimental Forest. Supplies and materials were purchased with NIRA funds. The construction work was practically completed with CWA labor. The Station is now supplied with electricity for lighting, heating, refrigeration and power.

Qualified CWA workers were assigned to the various National Forest headquarters in Idaho and Montana to prepare standard 2"-to-the-mile type maps for the Forest Survey. This project was particularly helpful in preparing for the survey field work for this summer and in clarifying our knowledge as to the amount and character of forest survey data available for the National Forests.

Clerical and computing help was made available for all of our project work and we are now more nearly abreast of the job in this field than for several years past.

One of the major projects completed with CWA help was the compiling for our records of all pertinent data secured by the Rural Housing Survey in Montana and Idaho. This information is yet to be analyzed but it should furnish much valuable knowledge for the Requirements Phase of the Forest Survey.

SELECTION OF RESEARCH AREAS

Little progress in this activity can be reported. Two areas were examined with a view to their withdrawal as natural areas, but final decision has not yet been reached in either case. The pressure of more urgent work precluded the allocation of much time or thought to this project. A preliminary examination was made of an area adjoining the Deerlodge Forest with the thought of its selection as a spring-fall range area. A more detailed study must be made this season before we can be sure that it is entirely suitable to our needs.

ARTICLE X OF THE LUMBER CODE

Much time was devoted to the preparation of woods practice rules for the various types represented in this Region. In this work the Station acted in the capacity of a consultant organization and made available all of the information in our files which would aid in working out practical rules for adoption by the industry. The data on selective logging, furnished by the Office of Forest Products, was particularly valuable.

PROGRESS BY LINES OF WORK DURING 1933

FOREST MANAGEMENT

SILVICULTURE

WHITE PINE REPRODUCTION STUDY

This project was started in 1926 and now embraces 34 permanent plots, 1149 quadrats, 4696 tagged trees, 102 seed traps, seed-stored-in-duff installations, and great number of small quadrats of sowed seedlings dealing intensively with causes of mortality. Numerous examinations are made annually, requiring a five-man crew for entire field season. Recent noteworthy results are: (1) Mortality as high as 90 per cent of all seedlings that germinate may occur in first three years, which signifies that abundant reproduction cannot be accepted as evidence of success until seedlings are over three years old; (2) Adequate seed trees start enough seedlings from year to year to produce a satisfactory cover of reproduction; (3) Seed stored in the duff is not viable after the second year, and consequently reproduction from this source cannot be depended upon unless a heavy seed crop occurred within two years preceding cutting; (4) The causes of greatest early seedling mortality are drought and high ground-surface temperatures, the latter reaching 120° to 150° F. during the hottest periods; (5) The greatest losses occur in clear-cut and the least in half-shaded areas, indicating need of some shelter during the establishment period of reproduction.

WHITE PINE METHODS OF CUTTING

Twenty-six of the permanent plots used in the reproduction study also serve to determine suitable methods of cutting. Methods studied include selection, shelterwood, and seed-tree types of cutting, and several methods of handling the hemlock problem. The plots are not old enough yet to yield results on increment. A strip study of 32 old cuttings made several years ago has supplied increment cores from 2814 trees, which furnish the basis for preliminary yield prediction in residual white pine stands.

PONDEROSA PINE METHODS OF CUTTING

Work on this project is restricted to three permanent plots to investigate possibilities of selective logging. They were established in 1932 at Greenough, Montana, in co-operation with the A.C.M. Lumber Company and other private and public agencies. The plots were logged according to clear cutting, economic selection and silvicultural selection methods. The Forest Products section of the Experiment Station is preparing for publication the data from the logging and milling phases of this study. The Silviculture section will conduct the periodic remeasurements of plots for growth and reproduction.

WHITE PINE GROWTH AND YIELD

This project includes 31 permanent and 56 semipermanent plots, established mostly between 1922 and 1926. Remeasurements are made at five- and ten-year intervals to determine

growth, yield and development of young stands. Five plots were remeasured in 1932, and seven in 1933.

PONDEROSA PINE GROWTH AND YIELD

This study is a part of an inter-Regional project to collect data for preparing even-aged, normal-yield tables, by site classes, for the entire range of the species. Thirty-three temporary plots were established by this Station in 1932, and three in 1933. Behre's 84 plots, selected in southern Idaho about 10 years ago, will also be used.

LARCH-DOUGLAS FIR GROWTH AND YIELD

Work on this project is confined to a study of growth of residual stands. Thirty temporary plots were selected in 30-year-old cuttings near Kalispell, Montana, in 1932. No work was done in 1933. Compilation of the data indicates an average annual growth of 70 board feet per acre where less than 2000 feet were left in logging, and of nearly 200 board feet per acre where 2000 to 4000 feet were left.

WHITE PINE THINNING METHODS

This project includes 25 permanent plots, 11 of which were established between 1914 and 1926. CCC and NIRA thinning activities made possible the establishment of 14 plots in 1933. Compilation of records of the older plots in stands over 60 years old indicates no significant increase in yield over unthinned plots, but does show increased size and quality

and greatly increased proportion of desirable species in crop trees.

PONDEROSA PINE THINNING METHODS

Nine plots were established in 1933, in connection with a thinning project conducted with CCC labor 20 miles from Missoula, Montana.

BOTANICAL STUDIES

This group of studies includes an arboretum of 160 acres at Priest River. Individual species are planted in blocks of one-fourth to one acre in size. Four blocks were planted in 1932, and 24 blocks in 1933. The project also includes 19 blocks of ponderosa pine racial varieties from points throughout the range of the species. Another phase of the project deals with phenological observations at 13 stations in Montana and northern Idaho.

FIRE RESEARCH

BEHAVIOR STUDIES

During the past two years the most outstanding progress in measuring fire danger has been along three lines: fundamental studies, instruments and application to research results.

First, as a result of Jemison's eight months' detail to the Washington Office, an intensive study employing advanced statistical methods of analysis is well under way and

is already producing much new, more dependable and fundamentally important information.

Second, a new instrument has been produced which will provide a continuous record of (1) duff moisture, (2) wood moistures, and (3) wind velocity. This instrument will make it possible to obtain records of these important factors of fire danger at administrative stations not continuously occupied and will also be used in a much-needed research investigation of fire danger on north versus south slopes by elevation classes. Another instrument developed recently is an inexpensive wind gauge for use at numerous field stations where it was impossible to provide the standard four-cup anemometer costing $75. The new gauges cost less than $3.00 each and are accurate to within one or two miles per hour for velocities between two and twenty-eight miles per hour. The Supervisors of the National Forests in Region One have ordered 147 of these gauges.

The third line of progress has been in the application of all these measurements of fire danger by use of the Fire Danger Meter. This device was given a field trial in 1932, and after slight revision was used daily on the 13 fire Forests throughout the 1933 season. As one result, it was possible for the first time to rate the character of a fire season on a numerical basis. The Supervisors; also, used this method in their daily reports of the status of fire danger.

Further progress also has been made in the application of research results by the addition of about 30 more inflammability stations in this Region, together with two in the National Parks and seven in R-4. These stations use 19 duff hygrometers and 38 sets of wood cylinders.

ATTACK

This project is divided into three phases: (1) determination of fire control requirements by analyzing records of all fires which occurred between 1921 and 1930, inclusive; (2) the determination of the best distribution of fire control endeavor (men and facilities) proportional to actual needs; (3) the collection of data in the field and the preparation of plans for fourteen million acres of eleven overburned Forests. A total of 150 men was trained for assistance in these two latter tasks.

Fire control preparations and fire suppression activities increase as periods of drouth continue. For each of five degrees of severity of burning conditions the stations to be occupied and the man-power to be placed to each have been specified. The individual construction projects (roads, trails, etc.) needed have been determined and rated in priority according to service rendered, permitting efficient allocation of funds.

The man-hours required to suppress any fire increase with the time between discovery and attack. Therefore, it was necessary to study the fuel types in order to predict the

probable rate of spread of small fires and the rate at which men could construct fire line (resistance to control). Therefore, the entire area for which plans were made was covered by a fuel-type map in terms of probable rate of spread and resistance to control.

Allowable travel time was worked out, correlating severity of burning conditions with fuels and strength of attack. The travel time limits, hence the area assignable to one or more men, can be expanded by new roads and trails.

The dual responsibilities of detection and smoke-chasing were assigned to every station. The occupant of every point views a certain area and chases smoke on an area which may or may not be the same as the seen area. By studying different combinations of stations it was possible to select the fewest number of stations to give the greatest total coverage for five types of organization. Similar coverage studies were made for small and large crew reinforcement attacks, assigning travel time limits to communities varying with available dependable man-power and the fuels to be covered.

The selection of the best composite coverage was accomplished by making silhouettes of individual station coverages. These were then stacked together in various combinations for sorting over a glass-top table lighted from beneath. For detection coverage the areas seen from 3,000 potential stations were mapped and studied, from which approximately 600 were selected as fitting best into composite relationships. The existing improved stations that fitted reasonably

well into composites were retained. In spite of concessions it was found that between 5 and 10 per cent of the existing stations could not be retained in any efficient combination. It was more economical to abandon them.

The coverage obtained by this method, as compared with the method of personal judgment previously used, shows that a cut of 20% (not less than $50,000 per year) in funds for man-power would provide as good coverage as before. This does not mean that such coverage would be satisfactory because the previous organizations were not strong enough to hold the area burned to acceptable limits. However, it does mean that this project has shown how to use most efficiently whatever funds may be available. In addition, and perhaps still more valuable, 100 men have been trained to think and work more analytically.

The total cost of this planning during the past three years has amounted to approximately $140,000, or about one cent per acre covered. It is evident that the project will repay its cost many times by the indicated permanent reduction of $50,000, or more, annually.

RANGE RESEARCH

Range research by this Station started from scratch in 1932, under a co-operative agreement with the Bureau of Animal Industry at old Fort Keogh, near Miles City, now known as the U. S. Range Livestock Experiment Station. The first appropriation bill limited work to old Fort Keogh. Subsequently, there have not been enough regular range investigative funds to expand to National Forest ranges. Emphasis has been placed almost exclusively on one project, Management of Short Grass Ranges, with a very small amount of work on the second project, Artificial Range Reseeding.

Under the first, a series of twelve pastures have been set up and are being grazed, six in summer and six during the winter, to determine the correct utilization practice, as well as comparative cattle production efficiency under three intensities of use, - overgrazing, moderate grazing and undergrazing. Weight data at approximately monthly intervals on three lots of twenty young range cows have been obtained during the past eighteen months, and the reaction of the vegetation in the different pastures has been measured by quadrats, height and volume measurements, etc.

Overgrazing during the past two seasons has not yet perceptibly damaged the range. This treatment has, however, reduced meat production per cow unit by 53.5 pounds during five months of 1932, and 58.5 pounds during the 1933 grazing year, - a total of 112.0 pounds, as compared to those cows

that had ample range forage. Thus at 4¢ per pound, a gross financial penalty of $4.48 per head was suffered by the producer in less than two years. At ten cents per acre lease price, the extra range used under conservative grazing would cost $1.48 for two years, leaving a net penalty of $3.00 per head due to overgrazing. This occurs before damage to the range is clearly demonstrable. A financial, as well as altruistic, motive for conservative range use, as against overgrazing, is thus provided by these data.

Limited artificial reseeding work on plowed and abandoned ranges has proved that crested wheat grass is well adapted to a wide range of soils in the harsh Miles City climate. Reseeding work is being expanded under NIRA funds to National Forests and under co-operative agreements to certain privately owned lands that have been abandoned to cultivation. Various other species are being used in these tests which are considered as demonstrations in most cases, rather than truly research in character.

FOREST SURVEY

The Forest Survey is an economic study of the timber supply situation from both the National and the Regional viewpoints. It is a study of present supply with relation to local industry, transportation and finance, and an attempt to forecast future supply and possibilities from an analysis of depletion and growth trends, all in the light of domestic requirements, present and prospective, for forest products.

When completed, the following results will be available:

1. Inventory Phase: The area of each type of forest cover and the estimated stand by species. Regrowth conditions on cut-over and burned lands will be determined.

2. Depletion Phase: Rate of depletion by cutting, fire, insects, disease, floods and any other factors.

3. Growth Phase: Growth rate in old stands and on restocking areas and probable future yields.

4. Requirement Phase: Present National and local requirements in forest products and probable trends.

The Forest Survey organization of this Station plans, as the first project, to cover the Inland Empire region. That part of Montana east of the Continental Divide will be handled as a separate project. The Inland Empire region includes the forested area in Montana west of the Continental Divide, Idaho north of the Salmon River, and Spokane, Pend Oreille and Stevens Counties in northeastern Washington, containing approximately 25½ million acres of forest lands. Fifty-three per cent of the above area, or 13½ million acres, is in the National Forests. Inventories of varying degrees of intensiveness have been made of the forest resources within these National Forests. At the start of the project practically no information, except that of estimates on merchantable timber, was available for the 12 million acres of public and privately owned forest lands outside the National Forests.

The most time-consuming phase of the project and the one put under way first was the inventory of the present

forest stand. Small regular appropriations have made it impossible to build up an organization large enough to function efficiently. To date, however, 1½ million acres of public and privately owned forest lands, mostly in Idaho, outside the National Forests, have been typed in place and cover maps prepared. In addition, the estimates on some 900,000 acres of merchantable timber have been collected from State and private owners. The estimates on approximately 170,000 acres of the above timber have been adjusted to survey standards by checking in the field.

Considerable information has been obtained on the Requirements Phase of the Survey through studies of building construction and contractors' records in the larger cities of the Inland Empire, and of the timber requirements of public utilities. Depletion data are collected annually by the Products, Fire, Blister Rust and Insect Control Offices within the Region. No work has yet been initiated on the Growth Phase of the Survey.

FOREST PRODUCTS

Forest Products research, as now handled by the Northern Rocky Mountain Experiment Station, is designed to be of maximum service to the industry and the Government in the field of economics of forest products production. The projects now under way are carried under the following main designations: (1) Logging and Milling Studies, (2) Woods

and Mill Utilization, (3) Species Utilization, (4) Wood Preservation, (5) Forest Statistics, and (6) Special Studies.

The logging and milling studies, - (1) selective logging and (2) logging output studies, - provide information on the important phases of forest products production. The final results of the selective logging studies will show for each commercial type in the Region and for individual holdings, the cutting limits and utilization standards necessary to provide a reasonable profit for the operator. The logging output studies are designed to measure the output of new logging equipment and new logging methods. Eight selective logging studies have been undertaken, - five in the ponderosa pine type of western Montana, two in the white pine type and one in the larch-Douglas fir type. Work during the past year, which will continue during 1934, covered the compilation, analyzing and preparing for publication all the data now available on the subject. All of the logging output data, secured up to 1931, have been published as Technical Bulletin #355. The studies will be continued as the opportunity presents itself.

The woods and mill utilization studies furnish information pertaining to overrun data, efficiency comparison of logging and milling equipment, waste investigations, and depreciation studies. The results of previous studies on overrun, sawmill efficiency, residual wood after logging, breakage in felling and depreciation through river driving, gravity

chuting and fire have been made available to the northwestern lumber industry.

The species utilization studies are designed to promote the good utilization of certain little-used species, thereby increasing the economic value of the source of our present timber supply. Bulletins on western hemlock, western larch and white fir have been published as a result of co-operation by this office, the Forest Products Laboratory and adjacent experiment stations. Preparation of the manuscript on lodgepole pine has been postponed because of recent serious insect losses in the species and the present economic conditions in the lumber industry.

Cost data and other information resulting from the Regional wood-preserving studies have been widely used in treating telephone poles, fence posts and stubs required in the constructing and maintaining of Forest Service improvements. Other Federal agencies, as well as some commercial companies and private individuals, make use of the basic information obtained from these studies. Many of the service test studies have been under observation for a great many years and are providing the only reliable data that can be obtained on the durability of treated and untreated woods in actual service and the efficiency of various preservatives and methods of treatment.

Current data are obtained on the amounts produced, production costs and selling values of the forest products

cut and manufactured within the Region. These data are used in figuring the sale value of Government-owned timber by the Federal agencies in Washington, Oregon, Idaho and Montana. Statistical information collected and compiled by this Station is used extensively by the Government agencies and the industry within the Region in many special reports.

Results of investigations carried on by the section of Forest Products have proved of much value during the past few months in furnishing the basic data for setting up the woods practices necessary for keeping forest land productive under Article X of the Lumber Industry Code.

PLANS FOR FISCAL YEAR 1935

In presenting the plans for the work of the Station for fiscal year 1935, no attempt will be made to segregate the work by the various appropriations from which funds are obtained. It is of interest to note that regular funds have now been reduced to the point where they will barely carry our permanent personnel, leaving almost nothing for travel and equipment. No temporary assistants can be financed from regular funds. In Range Research, the allotment is barely enough for the two project workers without allowing anything for station overhead expenses. The work of the Forest survey is, of course, financed entirely from emergency funds.

FOREST MANAGEMENT

The coming season's work in Forest Management will be greatly influenced by our plan to devote the major effort of our regular personnel to the analysis and publication of results. Excepting Gisborne, the field time of our Forest Management staff will be limited to absolutely essential supervision of going projects. We are fortunate in having available trained temporary men who can carry our field work for one season without a great deal of supervision. Haig will devote almost his entire time to the preparation of reports on the intensive seedling survival study, the growth on white pine cut-over lands project, and in assisting Weidman on a white pine silviculture bulletin. Weidman will start the ponderosa pine yield and larch-fir growth crews in their work and will spend the balance of his time on the white pine bulletin. Watts, with the help of Davis, Thompson and Professor Latham, will direct the stand improvement studies at the Priest River and Deception Creek Experimental Forests. Gisborne will handle the field phases of our fire behavior studies, leaving Jemison free to work on the statistical analysis of the factors affecting fire danger. Hornby will divide his time between the field supervision of the visibility and man-power placement studies and the preparation of a manuscript covering his work in these fields during the past three years.

WHITE PINE REPRODUCTION STUDY

The regular examinations of 1149 reproduction quadrats, the recording of the cone crop of 4696 tagged trees, the collection of seed from 102 seed trees and the testing of viability of seed stored in the duff will be continued.

The intensive seedling survival study, under way at Priest River, will be continued and will be expanded to include second-year survival and survival on steep slopes.

WHITE PINE METHOD OF CUTTING

The scheduled examinations of permanent plots will be completed and a report on certain phases of this project will be prepared for publication.

We hope, with the aid of CCC forces, to experiment with a new silvicultural system in overmature climax white pine. The questions involved have to do more with the practicability of logging under the proposed plan than with the silvicultural results obtainable. The accepted practice in such stands is to remove merchantable material, slash the residual defective hemlock, white fir and cedar, broadcast burn, and plant. Under the proposed experiment we will first dispose of the defective material, leaving all white pine for 3 to 5 years, until the area is completely restocked with seedlings, and then clean out the white pine. If this method proves feasible, it will eliminate the necessity for broadcast burning and planting. Even though the cost may be

greater than under the present method, the elimination of the damage to the soil by broadcast burning and the hazards of securing a second crop by planting may make the proposed system desirable in certain stands.

WHITE PINE MENSURATION

The only work planned for this project is the re-measurement of seven permanent plots.

PONDEROSA PINE MENSURATION

Approximately two months by a crew of three men will be spent on this project. It is planned to secure about 100 additional normal yield plots divided between Montana and the Black Hills. This will make about 135 plots in addition to the 84 plots measured by Behre some years ago. Upon completion of the field work the data will all be forwarded to Mr. Meyer of the Pacific Northwest Station for inclusion in the inter-Regional yield table.

LARCH-DOUGLAS FIR MENSURATION

Upon completion of the ponderosa pine yield study field work, the same crew will continue with the larch-fir study of growth after cutting. It is hoped to get about 80 additional plots in the Flathead, Kootenai and Missoula River valleys. This should give a fairly usable preliminary basis for the prediction of yields after cutting in this type.

WHITE PINE METHODS OF THINNING

After completion of the blister rust control work, about September 15, a part of the CCC force at Deception Creek and at Priest River will be used to continue our white pine thinning studies. Emphasis will be placed on the work in younger ages. One area of 10-15 year old pine at Deception Creek has been selected for a study of the effect of removal of competing hemlock saplings, and areas of 40-year-old pine have been tentatively selected for thinning at Priest River and Deception Creek. Detailed plans for the work will be prepared during the summer.

BOTANICAL STUDIES

Several additional blocks in our Priest River arboretum will be planted during the year. No attempt is made to stress this project unduly so long as reasonable progress can be made each year.

The phenological observations will be continued at a limited number of stations. A review of results to date has clearly shown that quality, rather than quantity, of observations will determine the usability of the data.

FIRE BEHAVIOR STUDIES

Plans for 1934 include (1) concentration of Jemison's time on the analysis of the data showing the relation of weather elements to duff and wood moisture on clear-cut, half-cut and full-timbered areas; (2) calibration of the 147 wind

gauges, 19 duff hygrometers and 38 sets of wood cylinders, and the personal checking by Gisborne of the location and operation of all 41 stations in this Region; (3) development of a standard exposure for hygrometers and cylinders so that the degree of danger shown by the various stations will be more nearly comparable; (4) initiation of the study of differences in danger on north versus south slopes by elevation; (5) improvement of the Fire Danger Meter by incorporating a new factor, green vegetation, which will probably require more than one season to develop; (6) continuation of the operation of the three standard stations at Priest River; and (7) the initiation of an intensive study of the effect on fire danger of seasonal and yearly variations in the amount and condition of understory vegetation.

FIRE ATTACK

The work planned under this project will consist of the preparation of a complete report showing the technique followed, and results obtained, from the so-called "Fire Control and Transportation Planning" study. Approximately half of Hornby's time, until early winter, will be devoted to this work. The balance of his time will be devoted to (1) the supervision of a field study of atmospheric transparency as related to visibility in this Region, (2) the direction of the work of smoothing out difficulties which have shown up in the various Forest plans already made, (3) the carrying of the plan over to private and State holdings in northern Idaho.

This last phase will provide an opportunity for applying the methods worked out to an area consisting largely of cut-over lands, or lands on which cutting will shortly take place. The difficulties of integrating the requirements incident to logging operations, which are covering new territory each year, with those for virgin timber will be many.

RANGE INVESTIGATIONS

With rather ample emergency funds, the work in range investigations can be expanded at least temporarily. The work planned is divided into three main projects.

MANAGEMENT OF SHORT GRASS RANGES

This project will be continued at Fort Keogh as during the past two years, except that sufficient help will be available to complete the installation and checking of the required number of quadrats in the twelve pastures. An attempt to stimulate the interest of the stockmen in this project will be made, either during the Montana Livestock Convention to be held in Miles City in May, or by arranging a small stockmen's field day later in the season.

ARTIFICIAL RESEEDING

This project includes the investigation of the possibilities of quick revegetation of depleted and overgrazed natural range lands and the establishment of profitable range forage on abandoned dry-farm wheat lands now producing only

worthless weeds.

Experimental sowings under the first condition are confined largely to the Range Livestock Experiment Station at Miles City, and to selected areas on the National Forests where proper protection, including fencing, is assured for the first few years.

Obviously, the rehabilitation of abandoned wheat farms must be conducted on private lands. Co-operative agreements, covering a period of five years, have been or will be executed with interested land owners. We will furnish the seed, decide on species and methods of sowing, in some instances bear part of the expense of fencing, determine the grazing use which may be allowed during the period, and make the necessary examinations. The landowners will furnish the equipment, sow the seed and, in most instances, fence the area to prevent abuse by stock. Fifteen to twenty experimental areas are contemplated in perhaps 10 or 12 counties in eastern Montana. Both spring and fall sowing has been planned. Crested wheat grass will be the main species used, although some 10 or 12 other species will be given a thorough trial.

The comparative values of various species will be thoroughly tested at Miles City, where a rather comprehensive series of acre plots have been arranged.

DEGREE OF DETERIORATION OF UNMANAGED RANGES

In order to determine with some degree of accuracy the present condition of unmanaged as compared to managed ranges, an intensive range reconnaissance of about 70,000 acres of land adjoining the Deerlodge Forest will be completed. The area known as Rochester Basin is typical spring-fall range and not unlike a part of the adjoining National Forest land covered by intensive reconnaissance last year. More than 60% of the area is public domain. The detailed data secured should be very useful in setting up administration of this and other similar range land.

Incidentally, this area was examined in a preliminary way with the thought that it might be a desirable location for a spring-fall range research substation. The data to be secured by this survey will enable us to make a final decision on this point.

FOREST SURVEY

The Forest Survey will go forward this year at a satisfactory rate. The allotment of emergency funds, both NIRA and ECW, to this project will enable us to employ about 24 mappers and perhaps two or three check cruisers. Funds are also available to hold about 8 men for office compilation during the winter of 1934-1935. It is planned to complete about 10 million acres this season, which, together with the 3 million acres already done, will cover about half the

timbered area in the Inland Empire. The study of timber requirements for building construction on the farms and in the cities, as well as that for other large users, will be continued during the fiscal year 1935. Depletion data will be collected by the Products, Fire, Blister Rust and Insect Control Offices within the Region.

FOREST PRODUCTS

LOGGING AND MILLING

While no new field projects are definitely planned, it is very probable that selective logging studies in the larch-fir and white pine type will be demanded because of the lack of usable data for the enforcement of the provisions of Article X of the Lumber Code. The only basis on which we could undertake such studies now would be that the expense, other than our regular salaries, be paid from funds allotted for Code enforcement, or from co-operative contributions by the industry. If no demand for additional studies arises, our efforts will be devoted to the completion of the Ohio Match Company study and the preparation of a ponderosa pine selective logging bulletin based on the several individual studies completed to date. The necessity and desirability of assisting in working out forest practice rules under the Code may place such a burden on our Products organization that little additional work can be accomplished. Inasmuch as the initiation of the practice of forestry on private lands is of

first-rate importance, I see no objection to the fullest kind of co-operation by our Products staff.

WOODS AND MILL UTILIZATION

No special program of work is planned under this project other than incidental time required for inquiries from various agencies concerning woods and mill utilization in this Region.

WOOD REQUIREMENTS

This project has been advanced materially during the past year by securing information from the Federal Civil Works Farm Housing Survey. Detailed data for four counties in Idaho and six counties in Montana were copied from the original schedules and are now available for analysis in our office. It is planned to supplement these data with additional material on requirements for fuel, fencing and outbuildings by sending out questionnaires to a random sample of those farms visited during the Rural Housing Survey. If this fails, we will obtain the data in accordance with Mr. Hallauer's work plan. Half of Mr. Whitney's time is available for this project.

WOOD PRESERVATION

Collection of service records for treated and untreated timbers will be continued. Eight test installations are up for examination this year.

If arrangements can be made, test installations to determine the effectiveness of petroleum oil containing tetrachlorophenol or orthophenylphenol will be initiated. This study has been suggested by Mr. Hunt of the Forest Products Laboratory in connection with some of our fencing projects.

STATISTICS ON FOREST PRODUCTS

It is planned to continue all phases of this project as usual, except that no financial co-operation by the Census Bureau is contemplated.

EXPERIMENT STATION PERSONNEL

Lyle F. Watts . . . . . Director

Forest Management

R. H. Weidman	Sr. Silviculturist	Silviculture
I. T. Haig	Assoc. "	
H. T. Gisborne	Silviculturist	Fire Research
L. G. Hornby	Reg. For. Inspector	
G. M. Jemison	Jr. Forester	
J. B. Thompson	Jr. Forester, Priest River Branch Sta.	
Kenneth Davis	Jr. Forester, Deception Creek " "	

Range Research

L. C. Hurtt	Assoc. Range Examiner
Fred H. Kennedy	Jr. " "

Forest Products

M. I. Bradner	Sr. Forester
I. V. Anderson	Assoc. Forester
C. N. Whitney	Asst. Forester

Forest Survey

M. I. Bradner	Sr. Forester
G. M. DeJarnette	Asst. Forester

Clerical

M. J. Pershina	Chief Clerk
L. J. Hinton	Clerk-Stenographer
Marie E. Bouchard	Jr. Clerk
Dagmar Duncan	Jr. Clerk-Stenographer

Regional Assignees

R. L. Space	Fire Research
C. B. Sutliff	

EXPENDITURES F.Y. 1934

(Estimated to 6-30-34)

Lines of Work	Regular Research Funds	Regional Contributions	Co-op. Funds	Emergency Funds			
				Reshira	ECW Research	Impnira	CWA
Forest Management							
B-1 Botany	153						
M-1 Management White Pine	4946	5398		1000	600	1300	1072
M-2 Management Pond. Pine	1488	1013			600	350	
Mt-1 Thinning White Pine	2640						
ME-1 Mensuration White Pine	500			2000			
ME-2 Mensuration Larch-Fir	47			1000			
ME-3 Mensuration Pond. Pine	343			740			
Pf-1 Attack	8300			1500	500		
Pf-2 Behavior	6537			1850	700		80
Lumber Code	336						
Plant Inves. Pr.R.-Decep. Cr.						9623	5192
Total	25290	6411	949	8090	2400	11273	6344
Range Investigations							
Mgt. Short Grass Ranges	5650			2700	2500	5520	231
Artificial Reseeding						3000	
Total	5650			2700	2500	8520	231
Forest Economics							
Forest Survey - Idaho	7072	16697			1500	5762	1366
Montana	4400	5267			1500	6761	3044
Washington	1200	2160			1000		
Total	12672	24124			4000	12523	4410
Forest Products							
Logging & Milling Studies	5009	200					629
Woods & Mill Utilization							
Wood Preservation	600						
Species Utilization	65						
Statistics	2580						400
Special Studies	1700						
Total	9954	200					1029

Form No. 1.

RESEARCH PROJECT ALLOTMENT SHEET

Northern Rocky Mountain Forest & Range Experiment Station

Fiscal Year 1935

Subappropriations & Projects	Regular Research Funds	Regional Contributions	Co-op. Funds	Emergency Funds		
				Resnira	ECW Research	Impnira
Forest Management						
B-1 Botany	1231					
M-1 Management White Pine	8358	5840		2500	2000	
M-2 Management Pond. Pine	280					
Mt-1 Thinning White Pine	468					
ME-1 Mensuration White Pine	936			500	375	
ME-2 Mensuration Larch-Fir	187			800	625	
ME-3 Mensuration Pond. Pine	375			1000	800	
Pf-1 Attack	5374			500	2000	
Pf-2 Behavior	8504			1000	800	(1)
Total	25713	5840		6300	6600	12750
Range Investigations						
Mgt. Short Grass Ranges	5829			800	5500	5943
Artificial Reseeding						4500
Total	5829			800	5500	10443
Forest Economics	(2)					
Forest Survey - Idaho	5443	6000			4000	6000
Montana	5444	3773			3000	5000
Washington		4400			4000	
Total	10887	14173			11000	11000
Forest Products						
Logging & Milling Studies	4970	1000				
Woods & Mill Utilization						
Wood Preservation	250					
Species Utilization						
Statistics	3906					
Special Studies	1500					
Total	10626	1000				

(1) Plant Investment at Priest River and Deception Creek Experimental Forests.

(2) Lunira money.

Form No. 3

ESTIMATED DISTRIBUTION OF DIRECT AND OVERHEAD EXPENDITURES

Northern Rocky Mountain Forest & Range Experiment Station

Fiscal Year 1935

Allotments	Forest Management	Range Investigations	Forest Products	Forest Survey	Total
Regular Research	Dollars 25,713	Dollars 5,829	Dollars 10,626	Dollars 10,887	Dollars 53,055
S&E, Region One	840				840
Impnira (Half of Total)	19,050	11,243		*25,173	55,466
ECF Research (Estimated Bal. as of 7/1/34)	6,600	5,500		11,000	23,100
ECF, Region One	5,000				5,000
TOTAL	57,203	22,572	10,626	47,060	137,461
Per Cent of Total	41.6	16.4	7.7	34.3	100.0
Proportionate Share of Overhead	Dollars 4,826	Dollars 1,906	Dollars 893	Dollars 3,979	Dollars 11,600

*This includes R-1 contribution to Forest Survey.

PUBLICATIONS

PUBLISHED SINCE LAST REPORT

1. An analysis of Log Production in the Inland Empire Region. Bradner, Girard, Fullaway and Klobucher. Technical Bulletin #355, June, 1933.
2. Fire Scarred Ponderosa Pine - What is the Loss? I. V. Anderson. The Timberman. April, 1934.
3. Residual Wood After Logging in the Western White Pine Region. I. V. Anderson. A mimeograph article. Sept., 1933.
4. Residual Wood After Logging in the Ponderosa Pine Region. I. V. Anderson. A mimeograph article. Sept., 1933.
5. Residual Wood After Logging in the Larch-Douglas Fir and Lodgepole Pine Type. I. V. Anderson. A mimeograph article. Sept., 1933.
6. Breakage Losses and Cull Per Cent of Timber in the Inland Empire. I. V. Anderson. Technical Note, No. 63. April, 1934.
7. An Economic Tree Classification for Ponderosa Pine. I. V. Anderson. Technical Note, No. 64. June, 1934.
8. Treatment of Understory Hemlock in the Western White Pine Type. I. T. Haig. Jour. For. May 1, 1933.
9. The Wood Cylinder Method of Measuring Forest Inflammability. H. T. Gisborne. Jour. For. Oct., 1933.
10. Progress in Forest Fire Research. H. T. Gisborne. Northwest Science. Sept., 1933.

11. Measuring Forest Fire Danger. H. T. Gisborne. Quarterly of the National Fire Protection Assoc. April, 1934.

12. Mrs. Robot is on Duty In Near-by Forests. H. T. Gisborne. Feature story, Spokesman Review. Aug. 1, 1933.

13. Deadwood Lying on Duff Drier than in Air. H. T. Gisborne. Jour. For. December, 1933.

14. Lightning and Forest Fires. H. T. Gisborne. Pulp and Paper of Canada. May, 1933.

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16. Progress of Research in Silviculture in the Inland Empire. R. H. Weidman. Northwest Science. Sept., 1933.

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18. How Big is a Livestock Ranch? L. C. Hurtt. The Montana Farmer. Mar. 1, 1934.

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1. Timber Growing and Logging Practice in Ponderosa Pine in the Northwest. R. H. Weidman. Tech. Bulletin. To Washington, June 5, 1934.
2. Some Climatic Effects on Forest Stands and Forest Types. R. H. Weidman. To Northwest Science, 1933.
3. Application of Selective Logging to a Ponderosa Pine Operation in Western Montana. I. V. Anderson. State University of Montana, Technical Bulletin. June, 1934.
4. Clean Cutting of Ponderosa Pine Versus Selective Cutting. I. V. Anderson. Jour. For. March, 1934.
5. Fuel Type Mapping. L. G. Hornby. Jour. For. Jan., 1934.
6. Beaufort Scale of Wind Force as Adapted for Use on Forested Areas in the Northern Rocky Mountains. G. M. Jemison. Jour. Ag. Res. March 5, 1934.
7. The Measurement of Fire Weather and Forest Inflammability. H. T. Gisborne. Submitted to Washington Office, February, 1934. Gov't circular.
8. Overgrazing Increases Cattle Production Costs. L. C. Hurtt. Submitted in February, 1933, to Producer.
9. A Method of Determining Spacing in Thinning. Kenneth Davis. Jour. For. March 13, 1934.

IN PREPARATION OR PROPOSED FOR F. Y. 1935

1. A Silvicultural Study of Western White Pine. R. H. Weidman and I. T. Haig. Technical Bulletin.
2. Some Aspects of Succession in the Ponderosa Pine Forest. R. H. Weidman. Ecology.
3. Sources of Regeneration Following Fires in the Western White Pine Type. R. H. Weidman. Jour. For.
4. Reproduction and Residual Growth on Cut-Over Areas in the Western White Pine Type. I. T. Haig. Final Report.
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10. A Ten-Year Record of Lightning and Forest Fires. H. T. Gisborne. Mo. Wea. Review.
11. Overgrazing Reduces Gains and Increases Cattle Production Costs. L. C. Hurtt. U.S.D.A. Yearbook article.
12. Summary of Reseeding Work. L. C. Hurtt. U.S.D.A. circular.

13. The Effect of Climatic Conditions on the Seasonal Growth and Development of Some of the Important Forage Grasses of the Northern Great Plains Region. Fred H. Kennedy. Article.

14. Forest Situation in Benewah County and Kootenai County. G. M. DeJarnette. Article.

15. Conversion Value of Idaho White Pine Commercial vs. Match Plank. I. V. Anderson. Trade Journal article.

16. Possibilities of Selective Cutting in Larch-Douglas Fir Stands of Western Montana. I. V. Anderson. Trade Journal article.

17. Log Grades for Ponderosa Pine. I. V. Anderson. The Timberman.

18. Trees That Are Logged at a Loss. I. V. Anderson. The Timberman.

19. Basic Information for the Practice of Selective Logging in the Ponderosa Pine Forests of the Inland Empire. Anderson and Bradner. Technical Bulletin.

20. Production of Lumber and Timber Products in Idaho and Montana, 1933. C. N. Whitney. The Timberman.

21. Service Records of Experimental Fence Posts at Miles City, Montana. C. N. Whitney. The Montana Farmer.

22. Durability of Cross-ties in Montana Test Tracks. C. N. Whitney. Applied Forestry Notes, N.R.M. Forest & Range Experiment Station.